REMARKS

Claims 1-14 and 16-40 are pending in the application. Claims 1, 18, 21, 24, 30, 33, and 35 are independent. Favorable reconsideration and further examination are respectfully requested.

The applicant's comments are preceded by related remarks of the examiner set forth in small bold font.

15. Claims l-20, 22, and 26 are rejected under 35 U. S. C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Applicants have amended the claims so as to satisfy the requirements of 35 U.S.C. 112.

18. Claims l-8, 14, 18-19, and 2l-22 are rejected under 3 5 U. S. C. 102(b) as being anticipated by Oda et. al. (12-1996').

Oda et. al. disclose a process for reducing the amount of micro-loading which occurs in an plasma etching process used to etch a Ta layer on a Si wafer during the production of an X-ray mask. They employ a plasma which is comprised of (SF6-CF4) to conduct their etching process. The flow ratio of these gasses is adjusted In order to minimize any observed micro-loading effect in the etching process. This is discussed on pages 4366-4370. This is shown In figures l-8.

19. Claims 1-8, 12-14, 18-19, and 21-26 are rejected under 35 U. S. C. 102(e) as being anticipated by Nallan (2002/O 132488).

Nallan discloses a process for rie etching a Ta gate layer on a Si wafer In an RF biased inductively coupled plasma etcher which is equipped with means for RF biasing the cathode electrode. The RF power source used to power the induction coil has a frequency of 12.56 MHZ. The RF power source used to power the cathode has a frequency of 13.56. A plasma which is comprised of an inorganic fluorine source such as (NF3 or CF4)plus a CxHyFz gas such as CF4 is used to rie etch the Ta layer. The concentration of the inorganic gas, and the CxHyFz gas are adjusted relative to each other in order to minimize any micro-loading effects observed in the rie etching step. This is discussed on pages l-5. This is shown In figures 1-2.

22. Claims 9-11 are rejected under 35 U. S. C. 103(a)as being unpatentable over Nallan as applied in paragraph 19 above.

23. Claims 9-13, and 16-17, 20, and 24-26 are rejected under 35 U. S. C. 103(a)as being unpatentable over Oda et. al. as applied in paragraph 18 above.

Claim 1 has been amended to recite "providing a substrate material comprising a quartz plate; providing a gas for generating a plasma, the gas including a first component and a second

component selected such that varying the ratio of the first component to the second component varies the rate of etching of one location of the substrate relative to another location on the substrate." Applicants submit that the limitations in amended claim 1 are not disclosed or suggested by any prior art references cited by the examiner.

Claims 2-17 depend on claim 1, and are patentable for at least the same reasons as claim 1.

Claim 21, as amended, recites "providing a gas for generating a plasma in a chamber, the gas including a first component and a second component, wherein the first component produces a positive plasma and the second component produces a negative plasma, the positive plasma having more electrons than negative ions, the negative plasma having more negative ions than electrons; ... and controlling the ion distribution within the chamber by selecting the amount of the first component and the second component" (emphasis added). Applicants submit that the limitations in amended claim 21 are not disclosed or suggested by any prior art references cited by the examiner. Instead, the art merely shows the use of different etchants, which may produce a positive plasma or a negative plasma depending on conditions of the chamber.

Claims 22-23 depend on claim 21, and are patentable for at least the same reasons as claim 21.

Claim 24, as amended, recites "a quartz plate supported by the support; ... wherein the first and second plasma gas are used to etch the quartz plate." Applicants submit that the limitations in amended claim 24 are not disclosed or suggested by any prior art references cited by the examiner. Instead, the art shows the use of two gases to etch Si, W, Mo, and tantalum.

Claims 25-26 depend on claim 24, and are patentable for at least the same reasons as claim 24.

Attached is a marked-up version of the changes being made by the current amendment.

In view of the foregoing amendments and remarks, the entire application is believed to be in condition for allowance, and such action is respectfully requested at the Examiner's earliest convenience.

Applicants' undersigned attorney can be reached at the address shown below.

Telephone calls regarding this application should be directed to the undersigned at 617-956-5959.

Enclosed is a $324 check for excess claim fees. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: 3/18/2003

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* See attached document certifying that Rex Huang has limited recognition to practice before the U.S. Patent and Trademark Office under 37 C.F.R. § 10.9(b).

VERSION WITH MARKINGS TO SHOW CHANGES MADE

-- 1. (Amended) A method [of plasma etching], comprising:

providing a substrate material comprising a quartz plate;

providing a gas for generating a plasma, the gas including a first component and a second component selected such that varying the ratio of the first component to the second component varies the rate of etching of one location of the substrate relative to another location on the substrate; [and]

generating the plasma; and

using the plasma to etch the substrate material.

6. (Amended) The method of claim 1 or 5, wherein said second component [is selected from the group consisting of] comprises at least one of silicon fluoride, phosphorous fluoride, and [sulfuric] sulfur fluoride.

13. (Amended) The method of claim 1, [wherein] further comprising sustaining the plasma [is sustained] by a first electromagnetic field and a second electromagnetic field, the first electromagnetic field having a frequency of about 13 megahertz, the [and a] second electromagnetic field having a frequency of about 2 magahertz.

16. (Amended) The method of claim 2, [wherein] further comprising controlling the rate of etching at the peripheral portion [at least about 50 mm from the central portion is] to be within about 1% of the rate of etching at the central portion, the peripheral portion being at least about 50 mm from the central portion.

17. (Amended) The method of claim 1, wherein the first component is carbon tetrafluoride, the second component is sulfur hexafluoride, the volume ratio of (first component):(second component) is about [20:1] 40:1, and the method further comprising sustaining the plasma [is sustained] by using a first electromagnetic field and a second electromagnetic field, the first electromagnetic field having a frequency of about 13 megahertz and [a] the second electromagnetic field having a frequency of about 2 megahertz.

18. (Amended) A method [of plasma etching], comprising:

providing a substrate material comprising a quartz plate,

providing a gas for generating a plasma, the gas including a first component comprising molecules C_xF_y, x and y being integers, and a second component [selected from the group consisting] comprises at least one of silicon fluoride, phosphorous fluoride, and [sulfuric] sulfur fluoride; [and]

generating the plasma; and

etching the substrate material.

21. (Amended) A method [of controlling a plasma], comprising:

[providing a chamber;]

providing a gas for generating a plasma in [the] a chamber, the gas including a first component and a second component, wherein the first component produces a positive [ion] plasma and the second component produces a negative [ion] plasma, the positive plasma having more electrons than negative ions, the negative plasma having more negative ions than electrons;

generating the plasma; and

controlling the ion distribution within the chamber by selecting the amount of the first component and the second component.

22. (Amended) The method of claim 21 wherein the first component comprises molecules C_xF_y, x and y being integers, and the second component [is selected from the group] comprises at least one of sulfur fluoride, silicon fluoride, and phosphorus fluoride.

24. (Amended) An apparatus [for etching a substrate material] comprising:

a chamber;

a support located within the chamber [to support the substrate material];

a quartz plate supported by the support;

a high frequency energy source;

a first gas supply providing a first gas, the first etchant gas comprising C_xF_y molecules, x and y being integers;

a first inlet for introducing the first gas into the chamber to form a first plasma gas when energized by the high frequency energy source;

a second gas supply providing a second gas, the second etchant gas comprising S_pF_q molecules, p and q being integers; and

a second inlet for introducing the second gas into the chamber to form a second plasma gas when energized by the high frequency energy source;

wherein the first and second plasma gas are used to etch the quartz plate.

26. (Amended) The apparatus of claim 24, wherein the first gas is carbon fluoride and the second gas is [sulfuric] sulfur fluoride. --

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Expires: June 3, 2003

Harry I. Moatz
Director of Enrollment and Discipline